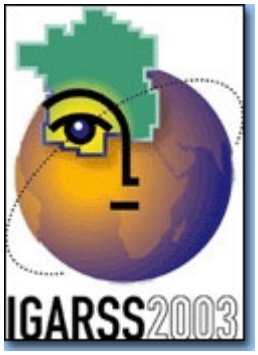
This year's theme was Learning Earth's Shapes and Colors. 149 topics were arranged into 7 sections, including:

- **Applications of Remote Sensing**
- **Mission and Programs**
- **Geoscience, Modeling, & Processing**
- **Data Processing & Algorithms**
- **Electromagnetic Problems**
- **Instrumentation & Techniques**
- **Policy, Societal Issues, & Education Initiatives**



Evaluation of Ice Concentration Algorithms Using Data Fusion of SSM/I and Radarsat

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ABSTRACT

The sea Ice concentration from the enhanced NASA Team (NT2) algorithm was evaluated against coincident Radarsat images. The evaluation approach uses a new data fusion technique accounting for the sensor's antenna pattern. Evaluation can be performed visually or statistically. This study involves cases from the Gulf of St. Lawrence, Canada during the winter of 2000. Results show good agreement between the data sets.

INTRODUCTION

Sea ice concentration is an important parameter from both an operational as well as climatic point of view. Several algorithms have been developed to calculate this parameter from microwave radiation observed by the Special Sensor Microwave Imager (SSM/I) onboard the Defense Meteorological Satellite Program (DMSP) (see [1] for an overview). Algorithms have been validated mainly through *in-situ* observations during field campaigns, comparisons against ice concentration derived from other sensors (namely visible and infrared), as well as aircraft observations and aerial photography [3,4].

The subject of this study is the validation of a more recent sea ice algorithm [2] (NT2) using operational RADARSAT images obtained from the Canadian Ice Service (CIS); the national agency that monitors sea ice in Canadian waters. The study uses a new approach of data fusion, whereby the actual footprints of SSM/I (as determined by antenna pattern) are overlaid on top of Raradsat images. The footprints are presented in colors that represent the calculated sea ice concentration. The sub-pixel contents of each SSM/I footprint can then be made visible through the co-located Radarsat images.

DATA SETS

The data set comprises all Radarsat scenes that were used by the Canadian Ice Service (CIS) of Environment Canada in their daily ice monitoring program over the Gulf of St. Lawrence from January to end of March 2000. Coincident SSM/I swath data were obtained from the archive of the Canadian Meteorological Centre (CMC). The time difference between Radarsat and SSM/I overpasses varied between a few minutes to a few hours, with typical values around 30 minutes.

METHODS

Co-location of the field of view (FOV) of each observation from the SSM/I swath data onto the coincident RADARSAT image was conducted following the method described in [5]. The FOV is represented by a polygon whose centre location is identified in the data stream and the vertices are calculated using the scanning geometry of the sensor. Ice concentration was calculated following the NT2 algorithm [2] using SSM/I brightness temperatures from 19, 37 and 85 GHz channels. The algorithm outputs the total ice concentration, with its components of first-year and thin ice concentrations. The final product of the present validation method is a Radarsat image on which the footprints of the coincident SSM/I data are overlaid. Footprints of SSM/I swath data are ellipses with different dimensions depending on frequency; the footprint size increases with decreasing frequency. Here, footprints of the 37 GHz channels are displayed as they represent the "medium size" among the footprints of the three frequencies that are used in the algorithm. The footprints are color coded to represent the calculated ice concentration.

CONCLUSIONS

A method of validating ice concentrations from passive microwave sensors against Radarsat images was developed that takes into account the SSM/I's antenna pattern. It was used to validate ice concentration from NT2 algorithm against Radarsat images and ice chart products from the Canadian Ice Service. Results show overall success of the NT2 algorithm in defining partial concentrations of first-year and thin ice types, with tendency to underestimate total ice concentration.